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ABSTRACT

This report focuses on one technology initiative, the Technology Literacy Challenge Fund (TLCF), and on five states as they attempted to implement the program in the first year of funding, 1997-98. The five states selected--Illinois, Massachusetts, Mississippi, Texas, and Washington--varied in their location, size, minority population, poverty levels, and approaches to infusing technology into K-12 education. (Findings do not necessarily generalize to other states.) The report presents key observations about three broad research questions: "What were the experiences of States and districts in implementing the Technology Literacy Challenge Fund?" "How were States and districts using the Technology Literacy Challenge Fund?" and "How did Technology Literacy Challenge Fund activities relate to other technology and reform efforts?" The report highlights a number of issues that could influence the impact of the program in the future. In addition, the five case studies provided an opportunity to identify the conditions that seem likely to influence the eventual success or failure of the TLCF program. (Contains 15 references.) (AEF)

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The First-Year Implementation of the Technology Literacy Challenge Fund in Five States

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EXECUTIVE SUMMARY

THE FIRST-YEAR IMPLEMENTATION OF THE TECHNOLOGY LITERACY CHALLENGE FUND IN FIVE STATES

In February 1996, President Clinton announced the Technology Literacy Challenge Fund (TLCF). Authorized in Title III, Part A, Subpart 2 of the Elementary and Secondary Education Act (ESEA), as amended by the Improving America's School Act (IASA) of 1994, the TLCF is the U.S. Department of Education's single largest investment dedicated specifically to increasing the effective use of technology in elementary and secondary education, particularly for those communities with high levels of poverty or with the greatest need for technology. In 1997, the first year of operation of the TLCF, this formula grant program provided $200 million to all States, territories, the District of Columbia, Puerto Rico, and the Bureau of Indian Affairs. Resources provided by the program are intended to serve as a catalyst to encourage States and a number of other parties—local communities, companies, universities, and others—to work together toward fully integrating technology into their curriculum and improving teaching and learning.

In December 1996, the U.S. Department of Education contracted with the American Institutes for Research (AIR) to conduct a formative evaluation of the first-year implementation of the TLCF. Funded before States even submitted their applications to receive TLCF support, the evaluation was designed to provide the U.S. Department of Education, Congress, and State education agency technology coordinators with information about the program's implementation and potential outcomes. This report summarizes one component of the evaluation: case studies of the experiences of five States as they implemented the TLCF. During intensive visits to States at two points in time, the spring and summer of 1997 and the fall and winter of 1997–98, AIR staff interviewed a host of individuals involved in implementing the TLCF in their States and schools, reviewed State technology plans, as well as those of local school districts, and observed teachers and students using technology. The five States selected—Illinois, Massachusetts, Mississippi, Texas, and Washington—varied in their location, size, minority population, poverty levels, and approaches to infusing technology into K–12 education. These States are not representative of all 50 States and the findings do not necessarily generalize to other States.

This report presents key observations about three broad research questions:

- What were the experiences of States and districts in implementing the Technology Literacy Challenge Fund?
- How were States and districts using the Technology Literacy Challenge Fund?
- How did Technology Literacy Challenge Fund activities relate to other technology and reform efforts?

In addition, this report highlights a number of issues that could influence the impact of the program in the future.

With regard to the experiences of States and districts in implementing the Technology Literacy Challenge Fund:

- While States and districts appreciated receiving TLCF funds quickly, districts would have liked more time to plan for the use of funds and to implement their plans.
- Competition within States sometimes put districts with fewer resources, less experience in writing grants, and less experience in planning for technology use at a disadvantage.
- The determination of district need for TLCF funds was inconsistent across States, making it difficult to determine whether the recipients of sub-grants were the most needy applicants.
- Leadership at the State, district, and school levels was critical to the implementation and operation of the TLCF.

Importantly, States and districts were using TLCF resources in a variety of ways:

- The TLCF was being used to support teaching and learning in a variety of different ways.
- The TLCF was being tailored to specific groups of students within districts.
- The TLCF was supporting a broad range of professional development efforts.
- The TLCF was being used to purchase a wide range of hardware and software.

With regard to the relation of TLCF-supported activities to other technology and reform efforts:

- The TLCF appeared to function best when implemented in the context of other technology programs.
- Other non-technology programs can also support technology needs.
- The TLCF is best understood within the context of State and districtwide reform efforts.

In addition, the five case studies provided an opportunity to identify the conditions that seem likely to influence the eventual success or failure of the TLCF program. These include:

- The TLCF's success or failure will depend on not spreading funds too thin.
- Identifying districts with the greatest need provided a challenge to States in implementing the TLCF.
- Sustaining technology's use in schools and classrooms will be one test of the TLCF's success.

- Leadership at the State, district, and school levels is critical to the operation and sustainability of technology initiatives.

- The flexibility of the TLCF requires careful monitoring on the part of the Federal government.

In this context, the Federal government will have to adopt creative approaches to communicating the intent of the TLCF, while at the same time, adapting to local circumstances. Monitoring a program as flexible as the TLCF is indeed a challenge, but one that could serve as a model for many other Federal programs as well.

PREFACE

Just as State and local education agencies collaborate with businesses, community organizations, and committed individuals to strengthen the potential of the Technology Literacy Challenge Fund, different offices within the U.S. Department of Education collaborate to provide a variety of technology programs and services. The Office of Elementary and Secondary Education (OESE) administers the Technology Literacy Challenge Fund program and the Office of Educational Research and Improvement (OERI) administers the Technology Innovation Challenge Grant and Star Schools programs. The Office of Educational Technology (OET) provides leadership not only within the U.S. Department of Education but outside as well, bringing together Federal, State, local, and private resources to promote the most effective uses of technology to improve teaching and learning.

This report focuses on only one technology initiative, the Technology Literacy Challenge Fund, and it focuses on only five States as they attempted to implement the program in the first year of funding, 1997–98. The experiences of these States cannot necessarily be generalized to other States but are presented as illustrations of the range of issues that can arise.

The U.S. Department of Education and the American Institutes for Research, the independent contractor for this evaluation, want to thank all of the many individuals in Illinois, Massachusetts, Mississippi, Texas, and Washington who shared their early experiences in implementing the Technology Literacy Challenge Fund during the site visits.

THE FIRST-YEAR IMPLEMENTATION OF THE TECHNOLOGY LITERACY CHALLENGE FUND IN FIVE STATES

INTRODUCTION

In February 1996, President Clinton announced a new technology initiative, the Technology Literacy Challenge Fund (TLCF). Authorized in Title III, Part A, Subpart 2 of the Elementary and Secondary Education Act (ESEA), as amended by the Improving America's School Act (IASA) of 1994, the TLCF is the U.S. Department of Education's largest, single investment dedicated specifically to increasing the effective use of technology in elementary and secondary education, particularly for those communities with high-levels of poverty or with the greatest need for technology. In 1997, the first year of operation of the TLCF, this formula grant program provided $200 million to all States, territories, the District of Columbia, Puerto Rico and the Bureau of Indian Affairs. Resources provided by the program are intended to serve as a catalyst to encourage States and a number of other parties—local communities, companies, universities, and others—to work together toward fully integrating technology into the curriculum and improving teaching and learning.

President Clinton articulated four national technology goals, or pillars, upon which the Technology Literacy Challenge is based. This challenge encompasses the TLCF, as well as the Technology Innovation Challenge Grant (TICG) program, an initiative that invites school districts, institutions of higher education, and private businesses to develop partnerships to foster innovative ways to use technology in schools. The four pillars upon which the TLCF and TICG programs are founded are:

- All teachers will have the training and support they need to help all students learn through computers and through the information superhighway;
- All teachers and students will have modern computers in their classrooms;
- Every classroom will be connected to the information superhighway; and
- Effective and engaging software and online resources will be an integral part of every school curriculum.

In December 1996, the U.S. Department of Education (ED) funded a formative evaluation of the first-year implementation of the TLCF. The purpose of the evaluation was to provide information to program managers and policymakers about how the TLCF was operating in its early stages. This report describes findings from a major component of this effort—case studies of five States' early experiences in operating the program. Based upon observations in these States and a select number of districts within each of them, this report describes (a) the initial implementation of the TLCF in these States and districts, focusing on how these States and districts were designing TLCF-funded activities and distributing funds to local school districts; (b) the types of activities the TLCF was supporting; and (c) the relationship between the TLCF and other technology and

education initiatives.[1] In addition, this report examines a number of emerging issues that could shape the future of the TLCF and other efforts to bring technology into America's schools and classrooms.

The TLCF in Context

Reflections on American education in the 1990s will certainly recognize the rapid growth in the use of technology in the classroom. In fact, between the 1991–92 and 1996–97 academic years, schools' inventories of computers grew 186 percent, with an additional 1.2 million computers added in 1996–97 alone (MDR, 1997). In addition, in 1996–97, there were an estimated 6.3 million computers in virtually 100 percent of the nation's schools (MDR, 1997); in 1998, 89 percent of schools maintained connections to the Internet (U.S. Department of Education, 1999). Yet, the integration of technology into teaching and learning is far from complete. A large proportion (two-thirds) of computers in schools and classrooms are not multimedia-compatible and thus only have limited capabilities to run new software and to take full advantage of resources, such as those offered through the Internet (MDR, 1997). Although the percentage of classrooms with Internet connections has been increasing dramatically, from 3 percent of all classrooms in 1994 to 51 percent in 1998, the percentage of classrooms linked to the Internet is considerably lower than the percentage of schools (U.S. Department of Education, 1999).

Many policymakers and researchers applaud this burgeoning expansion of technology applications in the nation's classrooms, because they believe that students will benefit. Researchers have documented that technology, when properly used, can facilitate the acquisition of basic and advanced skills in core academic subjects; provide opportunities for authentic learning experiences with access to experts, resources, and information beyond the classroom; can increase students' connections to life beyond the classroom and to the world of work; and can address the needs of all students by accommodating individual differences (Levin, Stephens, Kirshstein, and Birman, 1998; Means and Olson, 1997). While many believe that computers—and other technologies—will improve schooling, others are skeptical of this assertion (e.g., Noble, 1997; Oppenheimer, 1997; Stolls, 1995). Nonetheless, there is a growing consensus that technology has become so embedded in society and the workplace that students who do not have access to the latest technologies will be at a distinct disadvantage.

Concern over this possible disadvantage, sometimes referred to as the "digital divide," lies at the heart of the Technology Literacy Challenge Fund.[2] No single program can be expected to fill all of the identified needs for technology; the $200 million that the TLCF provided in fiscal year (FY) 1997 represented an extremely small proportion of even the lowest dollar estimates for providing an

[1]Observations in this report are from a limited number of States and should not be generalized to all States.

[2]Although classroom access to the Internet has been increasing for both low- and high-poverty schools, the digital divide remains. In 1998, 62 percent of classrooms had Internet access in low-poverty schools (where less than 11 percent of students were eligible for free or reduced price lunch), compared to 39 percent of classrooms in high poverty schools (where 71 percent or more of students were eligible for free or reduced price lunch) (NCES, 1999).

optimal level of technology in American schools.[3] Recognition of the enormity of the need for technology, as well as the inequities in the current distribution of technology in American schools, homes, and communities, is reflected in a number of the TLCF's key provisions. The program emphasizes using the award "to leverage additional support from business and industry and other public and private entities, including museums, libraries, and institutions of higher education to use technology to improve America's schools" (U.S. Department of Education, 1996). Furthermore, the non-regulatory guidance for the TLCF explicitly states that a "key purpose of the program is to enable States to assist school systems that have the highest numbers or percentages of children in poverty and demonstrate the greatest need for technology" (U.S. Department of Education, 1996). The TLCF's dual emphasis on leveraging other resources and targeting funds to school districts with the greatest need, recognizes both the relatively limited resources the TLCF represents in relation to overall technology needs and the concern over issues of equity with regard to the availability and use of technology in the nation's schools.

Key Features of the TLCF

The TLCF is a formula grant program that provides money to the 50 States, the District of Columbia, Puerto Rico, the territories, and the Bureau of Indian Affairs to accelerate the implementation of statewide technology plans. Funds are allocated to States proportionate to their share under Part A of Title I of ESEA—that is, proportionate to size and poverty level—but with a minimum allocation to any State of one-half of one percent of the amount appropriated. Additionally, one-half of one percent is distributed to the territories and the Bureau of Indian Affairs. Although all States are eligible to receive TLCF money, States must meet certain requirements and, in turn, local education agencies (LEAs) within the States must comply with certain guidelines to obtain funds.

Requirements of States. To be eligible for the TLCF in its first year, each State was required to prepare and submit an application to ED for approval by March 31, 1997. The application required that States provide a statewide educational technology plan that met the requirements set forth in Section 3133 of Title III of IASA (see exhibit 1).

State plans and applications were reviewed and approved on a rolling basis through a collegial peer review process established by ED that involved State technology coordinators and other experts in the review process. Review criteria included State progress in addressing the national technology goals, as well as financing strategies, targeting of resources, and quality of plans to distribute resources to LEAs. Feedback to each State on its plan and application was provided through this process. Upon award of a grant, each State distributed sub-grants to LEAs on a competitive basis; these sub-grants were required to be of a sufficient duration, size, scope, and quality to carry out the purposes of the program.

Exhibit 2 presents the timeline for implementing the TLCF in its first year of operation.

Requirements of LEAs. Section 3135 of the authorizing legislation also required that LEAs applying for sub-grants meet a number of criteria (see exhibit 3).

[3]Several groups have attempted to estimate what it would cost to provide instructional technology at some optimal level. These estimates, using varying assumptions, range from $6 to $28 billion per year (PCAST, 1997).

EXHIBIT 1

Requirements for State TLCF Grant Applications

Each State educational agency shall submit a statewide educational technology plan which may include plans submitted under the Goals 2000: Educate America Act or other statewide technology plans which meet the requirements of this section. Such application shall be submitted to the Secretary at such time, in such manner, and accompanied by such information as the Secretary may reasonably require. Each such application shall contain a systemic statewide plan that—

(1) outlines long-term strategies for financing technology education in the State and describes how business, industry, and other public and private agencies, including libraries, library literacy programs, and institutions of higher education, can participate in the implementation, ongoing planning, and support of the plan; and

(2) meets such other criteria as the Secretary may establish in order to enable such agency to provide assistance to local educational agencies that have the highest numbers or percentages of children in poverty and demonstrate the greatest need for technology, in order to enable such local educational agencies, for the benefit of school sites served by such local educational agencies, to carry out activities such as—

(A) purchasing quality technology resources;

(B) installing various linkages necessary to acquire connectivity;

(C) integrating technology into the curriculum in order to improve student learning and achievement;

(D) providing teachers and library media personnel with training or access to training;

(E) providing administrative and technical support and services that improve student learning through enriched technology-enhanced resources, including library media resources;

(F) promoting in individual schools the sharing, distribution, and application of educational technologies with demonstrated effectiveness;

(G) assisting schools in promoting parent involvement;

(H) assisting the community in providing literacy-related services;

(I) establishing partnerships with private or public educational providers or other entities to serve the needs of children in poverty; and

(J) providing assurances that financial assistance provided under this part shall supplement, not supplant, State and local funds.

Source: Public Law 103–382, Section 3133. State Application.

Flexibility of requirements. Beyond these requirements, TLCF guidelines provided States and the LEAs with considerable flexibility in implementing the program. Distribution of funds to States and from the States to local districts was very much dependent on the technology plans that each participating State and LEA developed, presumably to address its unique context and needs. Money was awarded to States based on a formula that considered both size and poverty, and States, in turn, were asked to consider the poverty and technology needs of LEAs in awarding sub-grants. Even these guidelines for awarding sub-grants could be interpreted differently from State to State.

EXHIBIT 2

Timeline for Implementing the First Year of the TLCF

Date	Milestone
October 1, 1996	Funds became available for the TLCF program
November 22, 1996	Secretary Riley sent letter to Chief State School Officers officially announcing program and applicable regulations
December 1996 – May 1997	Rolling ED review of State grant applications and awards
March 31, 1997	Grant application deadline for States
May 1997	ED grant award deadline (All States had received notice of their TLCF award)
Spring/Summer 1997	States provided technical assistance to LEAs and held sub-grantee competitions
Summer/Fall 1997	Awards announced to sub-grantees
Fall 1997/Winter 1998	Sub-grantees received funds from State to implement or continue progress on technology plan

Furthermore, TLCF guidelines allowed funds to be used for a wide range of purposes. The program's non-regulatory guidance summarizes the legislation by citing five major purposes: (1) applying technology to support school reform; (2) acquiring hardware and software to improve student learning; (3) acquiring connections to telecommunication networks to obtain access to resources and services; (4) providing ongoing professional development in the integration of technology into improvements of the school curriculum; and (5) providing better educational services for adults and families (U.S. Department of Education, 1996). As long as TLCF funds were used consistently with State and local plans, funds could indeed support a very broad range of purchases and activities.

Evaluating the First-Year Implementation of the TLCF

In December 1996, the U.S. Department of Education funded the American Institutes for Research (AIR) to conduct a formative evaluation of the first-year implementation of the TLCF. Funded before States even submitted their applications to receive TLCF support, the evaluation was designed to provide the U.S. Department of Education, Congress, and State education agency technology coordinators with valuable information that could help program managers and policy makers. The evaluation launched a number of efforts to summarize and collect information about States' experiences implementing the TLCF, the nation's and each of the State's progress toward achieving the four national technology goals, and the impact of technology on education in general. In addition, the evaluation was intended to assist States and local school districts to evaluate the use of technology in their own schools.

EXHIBIT 3

Requirements for LEA TLCF Sub-Grant Applications

Each local educational agency desiring assistance from a State educational agency under section 3132(a)(2) shall submit an application, consistent with the objectives of the systemic statewide plan, to the State educational agency at such time, in such manner and accompanied by such information as the State educational agency may reasonably require. Such application, at a minimum, shall—

(1) include a strategic, long-range (3- to 5-year), plan that includes—

- (A) a description of the type of technologies to be acquired, including specific provisions for interoperability among components of such technologies and, to the extent practicable, with existing technologies;
- (B) an explanation of how the acquired technologies will be integrated into the curriculum to help the local educational agency enhance teaching, training, and student achievement;
- (C) an explanation of how programs will be developed in collaboration with existing adult literacy services providers to maximize the use of such technologies;
- (D) (i) a description of how the local educational agency will ensure ongoing, sustained professional development for teachers, administrators, and school library media personnel served by the local educational agency to further the use of technology in the classroom or library media center; and
  - (ii) a list of the source or sources of ongoing training and technical assistance available to schools, teachers, and administrators served by the local educational agency, such as State technology offices, intermediate educational support units, regional educational laboratories, or institutions of higher education;
- (E) a description of the supporting resources, such as services, software, and print resources, which will be acquired to ensure successful and effective use of technologies acquired under this section;
- (F) the projected timetable for implementing such plan in schools;
- (G) the projected cost of technologies to be acquired and related expenses needed to implement such plan; and
- (H) a description of how the local educational agency will coordinate the technology provided pursuant to this subpart with other grant funds available for technology from State and local sources;

(2) describe how the local educational agency will involve parents, public libraries, business leaders and community leaders in the development of such a plan;

(3) describe how the acquired instructionally based technologies will help the local educational agency—

- (A) promote equity in education in order to support State content standards and State student performance standards that may be developed; and
- (B) provide access for teachers, parents, and students to the best teaching practices and curriculum resources through technology; and

(4) describe a process for the ongoing evaluation of how technologies acquired under this section—

- (A) will be integrated into the school curriculum; and
- (B) will affect student achievement and progress toward meeting the National Education Goals and any challenging State content standards, and State student performance standards that may be developed.

Source: Public Law 103-382, Section 3135. Local Application.

In addition to the national evaluation of the program, States and districts that received State TLCF awards were asked to evaluate their initiatives. At the time of AIR's site visits, both to the States and to the districts, very little was planned or underway with regard to local evaluations that would measure the projects' impacts on students.

This report summarizes a key element of the formative evaluation: case studies of the experiences of five States as they implemented the TLCF. During intensive visits to States at two points in time, AIR staff interviewed a host of individuals involved in implementing the TLCF in their States and schools, reviewed State technology plans, as well as those of local school districts, and observed teachers and students using technology in their teaching and learning. States selected as case study sites varied in their location, size, minority population, and poverty levels. In addition, States varied in their stages of using technology in their schools. Exhibit 4 presents an overview of these five States—Illinois, Massachusetts, Mississippi, Texas, and Washington.

EXHIBIT 4

Characteristics of Case Study States

State	No. of Districts No. of Schools	No. of Students	Minority/Poverty Composition	Location
Illinois	906 districts 4,142 schools	1,943,623	36% minority 21% children living in poverty	Midwest
Massachusetts	347 districts 1,850 schools	915,007	21% minority 26% children living in poverty	Northeast
Mississippi	153 districts 1,011 schools	506,272	52% minority 33% children living in poverty	South
Texas	1,044 districts 6,638 schools	3,748,167	54% minority 25% children living in poverty	Southwest
Washington	296 districts 2,124 schools	956,572	22% minority 13% children living in poverty	Northwest

Source: CCSSO, 1997 (poverty data). U.S. Department of Education, 1997 (all other data).

AIR staff conducted the first round of case studies in the spring and summer of 1997. At this time, most of the States visited had issued requests for proposals from local school districts, the districts had submitted applications for TLCF money, and States were in the process of awarding funds. These first visits focused entirely on the initial implementation and administration of the TLCF at the State level. Typically, a number of people were interviewed, including the State technology coordinator, professional development coordinator, curriculum specialist, persons involved in the administration of other technology programs, and other technology stakeholders (e.g., associations or commissions dealing with technology issues at the State level).

The second wave of case studies, conducted in the fall and winter of 1997–98, focused on three to five school districts that had been awarded TLCF grants within each of the five States. These districts were selected to represent diversity in location within the State, size of the district, and the way the TLCF was used. Districts that did not receive sub-grants, either because they had applied for the TLCF but did not receive an award, or because they did not apply at all, were not visited. During the site visits, which typically lasted 4 to 5 days, AIR staff interviewed a broad range

of individuals that included district and school technology coordinators, superintendents, principals, and teachers. In addition, AIR staff observed many classrooms and talked informally with students. In many cases, samples of student work that used technology were reviewed and documents that described how schools were using or planning to use technology were examined.

This report summarizes observations from these five State case studies. Observations about the implementation of the TLCF in these States are organized in response to three general research questions:

(1) What were the experiences of States and districts in implementing the Technology Literacy Challenge Fund?

(2) How were States and districts using the Technology Literacy Challenge Fund?

(3) How did Technology Literacy Challenge Fund activities relate to other technology and reform efforts?

In addition, this report highlights a number of issues that could determine the success or failure of the initiative over time.

CASE STUDY FINDINGS

What Were the Experiences of States and Districts in Implementing the Technology Literacy Challenge Fund?

The TLCF is a program of tremendous flexibility by design. The program offers States an opportunity to provide school districts, especially those with high rates of poverty and technology needs, with funds for appropriate and effective uses of technology.

This type of flexibility is necessary given the variation across States and school districts in the use of technology in the classroom. Results of a survey conducted by Market Data Retrieval, for example, indicate that the number of students per multimedia computer ranged from 20 in Illinois and Texas to 28 in Mississippi in 1996–97. Furthermore, while fewer than half of all schools in Mississippi—44 percent—reported having access to the Internet, 80 percent of the schools in Washington State had Internet access (MDR, 1997, as reported in *Education Week*, 1997). A "one size fits all" program would certainly not fit the needs of the five States visited, nor would it work for the other 45 States, the District of Columbia, Puerto Rico, the territories, and Bureau of Indian Affairs that the TLCF serves.

The different ways that Illinois, Massachusetts, Mississippi, Texas, and Washington chose to implement the TLCF illustrate the program's flexibility. Exhibit 5 provides a brief overview of how each of these States adapted the TLCF requirements to their needs.

The TLCF allocations of the five case study States ranged from $2.8 million in Washington to $16.3 in Texas. The number of awards within these States also varied, from eight in Washington to 121 in Massachusetts. It is worth noting that while the allocations were relatively similar in these

EXHIBIT 5

Overview of State TLCF Awards

State	Allocation (in millions)	Number of Awards	Amount of Awards	% Based on Poverty Criteria	% Based on High Technology Needed
Illinois	$9.1	52	$34,094–$2,340,000	44%	100%
Massachusetts	$3.4	121	$31,000–$280,000	45%	42%
Mississippi	$3.5	21	$95,800–$200,000	100%	100%
Texas	$16.3	19	$43,3500–$4,500,000	100%	100%
Washington	$2.8	8*	$114,865–$588,530	100%	100%

*All consortia awards
Source: TLCF State Performance Report, May 1999.

two States—$2.8 million and $3.5 million—the ways in which Washington and Massachusetts distributed the TLCF money were radically different. Washington's eight awards all went to consortia of school districts, while Massachusetts' 121 awards often tended to be relatively small, ranging from $3,000 to $280,000. Furthermore, Illinois and Massachusetts indicated that less than half of their awards went to districts defined as high poverty, while the three other States awarded all of their TLCF money to districts they defined as high poverty. Finally, Massachusetts was the only State that appeared to award some of its TLCF money to districts not defined as having high technology need. While this variation in implementation of the TLCF reflects its flexibility, the spirit of the TLCF was perhaps compromised by the rather small awards that Massachusetts distributed in its first year. This issue is discussed later in the report.

ILLINOIS

Illinois had considerable experience implementing statewide technology initiatives. In place at the time Illinois received TLCF funding were a State telecommunications backbone; regional learning technology hubs; a competitive grant program focused on innovative uses of technology and its integration into the curriculum; and a formula grant program that aimed to provide districts with funds to build their technology infrastructure. In addition, Illinois had received four Technology Innovation Challenge Grant awards. Many of the technology initiatives in the State were aimed at fostering engaged learning, an approach that emphasizes student responsibility for learning and collaboration.

In setting up its sub-grant competition, Illinois divided the State allocation into seven parts based on geographic regions; Chicago formed one of these regions. This structure was chosen, because without it, Chicago's sheer size and poverty would have made it eligible for the lion's share of funds for programs like the TLCF intended to target need. School districts could apply for the TLCF within their region (in Chicago, schools competed against each other) for a single district award, or districts could partner with other districts in their region or another region for a regional award. In addition, districts could partner with other districts in more than one other region for a

statewide award—this was considered a separate competition. This system allowed the many rural one-school districts throughout the State to compete for funds.

Illinois also required that districts spend at least 25 percent of their award on professional development and not more than 50 percent on hardware. Although need was not listed in the sub-grant application as an official criterion, the State Department of Education expressed that need was considered in the award decisions. According to officials in several districts, however, need was a relatively small factor. Some at the district level also believed that needier districts were doubly disadvantaged since some wealthier districts hired professional grant writers.

> Illinois is unique among the five case study States for its emphasis on engaged learning.

Illinois received 664 applications for its $9.1 million TLCF grant, which were reviewed in 2 days. Fifty-one awards were made, the majority of which went to single-school districts. The minimum award amount was $34,094, for districts of less than 1,000 students; the maximum was $340,000, which was provided to consortia comprised of not less than three districts from across the State.

MASSACHUSETTS

The State of Massachusetts was in the midst of implementing a number of educational reforms at the time the TLCF was announced. One major activity that was underway was the continued implementation of the Massachusetts Educational Reform Act (MERA). MERA was a $6 billion formula grant program that assisted districts in meeting their Foundation Budget, a State-determined funding level to ensure school financial equity across the State. The State Department of Education had also been busy developing a statewide professional development program, new State curriculum frameworks, and an accompanying statewide assessment program. The two major technology initiatives in Massachusetts were the Information Management System, that was to modernize administrative processes, and the Educational Technology Bond Bill, that provided $30 per pupil to all districts with a local technology plan (while requiring districts to match State dollars on a 3 to 1 basis). While these two initiatives represented well over $30 million dollars of investment, funding for technology in Massachusetts had historically been more limited.

> Massachusetts was the only case study State that distributed the TLCF so widely; about 34 percent of all districts received some type of award.

At the time of the TLCF announcement, Massachusetts did have a State technology plan in place that focused on hardware, Internet connections, and professional development. Underlying that plan was the belief that the best way to maximize limited resources was to use them at the State level to create economies of scale. As such, Massachusetts used its $3.4 million first-year TLCF allocation to support four types of sub-grants, with predetermined funding levels:

(1) *Need-Based Professional Development Grants.* The largest of the programs, these grants supported quality professional development for teachers and administrators across the Commonwealth, particularly those who were in school districts that had high percentages of students in poverty and need for technology, in using new technologies to improve education.

(2) *Lighthouse Technology Sites.* This grant was used to identify and recognize school districts that were using innovative technologies in a classroom, school building, or across the school district, and to enable them to share their expertise with other school districts in the commonwealth. Selected recipients were to serve as models, mentors, and supporters for other school districts in the creative and effective use of innovative technologies.

(3) *Teacher Sabbaticals.* This program identified two talented educators to serve a 1-year sabbatical as statewide technology leaders to work with other teachers and administrators through posts at the State Department of Education.

(4) *Projects with Statewide Impact.* Representing the largest single award, this program supported school district(s) to form partnerships with higher education institutions, business communities, and others in order to foster statewide impact in the use of technology in the classroom.

MISSISSIPPI

Although in recent years Mississippi had made gains in the level of technology in its schools—rising from 48th to 34th in student-to-computer ratio (QED, 1997)—it still lagged behind many other States. Because of high poverty levels across the State, the vast majority of its districts were still in the initial hardware-purchasing stages of technology implementation in 1997.

In 1994, the Mississippi legislature passed the Education Technology Enhancement Act. This landmark bill called for the development of Mississippi's *Master Plan for Education Technology;* established the Council for Education Technology (an advisory group made up of representatives from public education, various State agencies, and private business and industry); and earmarked $30 million to spend on building the State's data backbone, which would bring Internet access to every school in the State. This legislation also included the development of standards for technology and professional development.

The TLCF brought to Mississippi an additional $3.5 million to help local districts purchase the hardware necessary to connect to the State backbone. The TLCF in Mississippi was designed to support sub-grants ranging in award size from $100,000 to $200,000. Similar to Illinois, Mississippi required that districts spend at least 20 percent of the TLCF grant on professional development. According to State officials, extra consideration was given to districts with above average student-to-computer ratios and higher poverty levels.

> Mississippi was the only State among the case study sites to award exclusively single-district grants. Mississippi was also the case study State with the greatest need for technology in its schools.

One hundred twenty-six districts applied for TLCF money and four teams of three reviewers evaluated the applications. In the end, 21 districts were awarded sub-grants.

TEXAS

One of the first States to develop a technology plan (Texas had a plan in place since 1988), Texas had invested heavily in its technology infrastructure. One of the first outgrowths of the plan was the Texas Education Network (TENET), the text-based network and communications backbone to which all teachers were connected. Additionally, there was a satellite system, T-STAR, that connected all school districts and a high-speed Intranet connection linking the Texas Education Agency with 20 regional service centers. Together, these systems were used for meetings, disseminating information, and training via videoconferencing. More recent technology initiatives focused on the curriculum, adding a required high school course in technology applications. Texas legislators also had considered replacing textbooks with laptops. Texas, relative to other case study States, was thus ahead of the technology implementation curve when the TLCF was announced.

Texas used its $16.3 million TLCF allocation to fund the *Technology Integration in Education* program. The State focused on four areas with its competitive sub-grants: teaching and learning, educator preparation and development, administration and support services, and infrastructure. Districts were required to specify which of the four areas their sub-grant addressed, although there was no preset monetary distribution among the four focal areas. One sub-grant selection criterion was classification as rural or emphasis on collaboration in project designs.

Texas awarded the largest sub-grants of any case study State. The average award was over $850,000.

Two hundred sixty-one applications were submitted and determined eligible, the bulk of which were from single districts. Five reviewers evaluated each application; the 65 top-rated proposals were selected as finalists. After further deliberation, the State awarded 19 sub-grants to districts or consortia, with the majority ranging from $43,000 to $1,600,000. One large consortium received $4,500,000.

WASHINGTON

With 88 percent of its schools connected to the Internet and an average of 23 students per multimedia computer, Washington fared somewhat better in terms of technology availability than some of the other case study States. In Washington, like in Illinois and Texas, the State was divided into eight Educational Service Districts (ESDs), or "hubs," that provided technical assistance to each region of the State. The ESDs helped districts to implement their technology plans. Some districts also received financial assistance from the State competitive grant program for technology. This program provided about $20 million per year via a competitive process. The State competitive grants also required that one-fifth of the award be spent on professional development. Finally, Washington was in the process of establishing the "K–20 Backbone," which would connect every school in every district to the ESDs, the State Education Agency, 2- and 4-year colleges and universities, and libraries.

As required, Washington used its TLCF allocation—$2.8 million—to fund a competitive grant program for which all districts that had submitted a technology plan were eligible. However, what was unique about Washington State was the way it tied some additional requirements to the grant application and its approach to targeting poor districts. The grant program required (a) that districts form consortia with other districts and partners and (b) that 60 percent of all funds be

distributed to districts designated as "high need." It was hoped that these two requirements would encourage districts of varying levels of need to partner together, so the wealthier, presumably more advanced, districts could mentor the needier districts.

Altogether, Washington received 30 applications, representing over 100 districts. Within 1 week, six reviewers read each application. The review panel then discussed the top-rated proposals and awarded grants to eight consortia that served over 40 districts. The awards ranged in size from $115,000 to $588,000.

> Of all the case study States, Washington made the smallest number of awards. It also was the only case study State that made no awards to single districts and that mandated that a high proportion of the funds go to high-need districts.

Cross-Case Observations

Observation 1: ***While States and districts appreciated receiving TLCF funds quickly, districts would have liked more time to plan for the use of funds and to implement their plans.***

The U.S. Department of Education distributed TLCF funds to States very expeditiously. The program was announced in October 1996, applications were received and reviewed during the period January to May 1997. In order to distribute TLCF money in the necessary timeframe (see exhibit 2), the U.S. Department of Education recognized that application requirements had to be kept relatively simple. To receive TLCF funds, States were asked to submit a technology plan that included long-term strategies for financing educational technology, the role of businesses and other community agencies in supporting educational technology, and methods for targeting funds to the neediest districts. All case study States had technology plans at the time the TLCF was announced and if these plans included these key elements, applying was, in the words of one State technology coordinator, "a breeze."

Interviews at the State level revealed that, generally, States appreciated the speed with which the U.S. Department of Education awarded the TLCF money. However, the speed with which districts were required to submit applications, implement the program if funded, and confusion regarding the amount of time they had to spend the TLCF funds, posed some difficulties for the school districts visited.

One difficulty was that some districts did not have sufficient time to thoughtfully develop technology plans, according to district and State officials. Federal guidelines required that LEA applications to States had to include "a strategic 3- to 5-year plan that addresses the types of technologies to be acquired, how they will be integrated into the curriculum, collaborative efforts to maximize the use of technology, professional development, existing sources of supporting resources, projected costs, and mechanisms to coordinate all technology funds" (U.S. Department of Education, 1996). Generally, in the States visited, competitions for funds were announced in the spring of 1997 and districts prepared their applications in a matter of weeks. Yet, many of the local school districts did not have technology plans at the time the TLCF was announced. In Illinois, this meant that about 250 districts did not apply for TLCF funds, most likely because they did not have approved technology plans, according to the State coordinator. In other States, this short time period meant

that some of the districts that decided to apply to States for funding had to scramble to put together plans.

Some plans reflected this limited time; some were sketchy, superficial, and lacked a long-term vision. In one district visited, for example, a school that had received TLCF funding as part of its district's TLCF sub-grant, shared a list of its projected equipment purchases over the next 2 years. This list, with minimal discussion of the proposed uses of the equipment, or other rationale for the configuration of equipment, comprised the school's technology plan. Officials in Washington State felt that it was unreasonable to require districts to provide a technology plan in the TLCF sub-grant application. Officials in this State said that most districts did not have plans at the time of the announcement, and had to put something together within 6 weeks to meet the proposal deadline. These officials felt that, realistically, technology plans require a good year to develop, and constantly evolve.

In addition to having to apply for funds quickly, districts in the case study States had relatively little time to spend their TLCF funds. In a number of cases, States did not award local TLCF sub-grants until the end of 1997, and many districts were required by their States to complete their projects by the end of the school year, a 5-month period. For some of the larger projects, like the $4.5 million Texas Panhandle Consortium sub-grant, allowing the project to expend this sizeable amount of funds beyond the single school year would have given the project's staff more time to reflect on implementation issues, and make mid-course corrections. This would have been particularly helpful to this sub-grant, which was using new telecommunications technologies to provide teachers in rural areas with professional development regarding technology integration in their classrooms. Because funds were not received until the end of 1997 and the grant began with purchasing and setting up equipment, the professional development itself was planned for a relatively short time frame—6 to 8 weeks. The literature suggests a more extended time frame is needed if the professional development is to be effective (e.g., Stiles, Loucks-Horsley, and Hewson, 1996).

A number of districts visited recognized that their activities could benefit from continued funding. While the Federal government allowed and encouraged multi-year awards, the States visited varied with regard to whether they would allow districts to reapply for funding. In Mississippi, districts that had received TLCF sub-grants in the first-year of funding could not reapply the following year. In all of the other States that were visited, districts that had received funding in the first-year could reapply.

However, the odds that districts would actually apply for and receive second-year funds appeared to be limited because of the timing of the FY98 and FY99 grants, the desire of State coordinators to provide funding to districts that had not yet benefited, and the inconvenience of having to apply for funds a second time. In Texas, for example, because the grants ran on overlapping cycles, some districts that had received awards for FY98 were in the midst of implementing their projects and trying to decide whether to take time and resources away from this process to apply for a continuation of funds. The State coordinator in Texas also indicated that, while districts were free to reapply for second-year funding, they might be considered to need the funds less than applicants who had not yet received funds from the program. In contrast, the State coordinator in Washington felt that districts should be able to receive continuation funding through the TLCF; she felt that it was necessary for districts to receive TLCF funding over a period of longer

than 1 year to really show an impact. Consequently, she felt that districts that had received first-year funds and were doing well should not have to compete for a second year of funding.

Observation 2: ***Competition within States sometimes put districts with fewer resources, less experience in writing grants, and less experience in planning for technology use at a disadvantage.***

As discussed earlier, a key purpose of the TLCF program was to enable the States to assist school systems that had the highest numbers or percentages of children in poverty and demonstrated the greatest need for technology. However, needier districts sometimes appeared to be at a disadvantage in the competitive process. Some districts that perhaps needed technology the most did not have technology plans they could take off the shelf, according to State officials. These districts also appeared less likely to have staff knowledgeable and available to develop them. In a number of the case study States, the officials that were interviewed believed that this gave less needy districts an unfair advantage. Indeed, some districts with the resources to do so even hired professional grant writers.

The competitive process appeared to be particularly difficult in cases where LEAs, consisting of individual schools, applied for funds. In a number of rural areas in Texas, for example, many districts consisted of single schools. The district superintendent was also the school principal, and in some cases, a teacher as well. These individuals were often overworked and lacked both the time and energy to put together a winning application for TLCF funds. Individual schools sometimes were required to apply for funds within large urban districts as well. (Note that in these cases the district still applied to the State for funding. School-level application allowed these large districts to identify schools needs for technology). In Chicago, for example, because the city was one of seven Hubs in Illinois, schools competed with one another for TLCF resources. Yet, less than 200 of the city's 557 schools had approved technology plans at the time interviews were conducted; since schools often did not have the expertise to put together a high-quality technology plan or application, they could not take advantage of the TLCF, according to district officials.

Some of these problems could possibly have been ameliorated through technical assistance to sub-grantees. Indeed, most States that were visited provided assistance to local districts in developing technology plans. Mississippi, for example, ran workshops for all districts. State officials also offered to meet one-on-one with district technology coordinators to assist them in writing a technology plan and completing the TLCF application. In Illinois, the seven Hubs were responsible for assisting the districts (or in the case of Chicago, the schools) to write technology plans. It was not possible to ascertain, however, whether this assistance was sufficient to enable districts with minimal resources and experience to apply for funds.

The State of Washington had a unique approach to overcoming needy districts' competitive disadvantage. In that State, districts had to apply as part of a consortium of districts and other partners, with 60 percent of funds going to districts with high needs. This strategy enabled needy districts to receive funds without having to compete directly with less needy districts.

In requiring that funds be awarded competitively within States, the TLCF program set up a tension for State officials. State officials, while they wanted to ensure that students and districts with

the greatest need gained access to technology they may not otherwise have had, also wanted to ensure that funds were used wisely and well.

Observation 3: ***The determination of district need for TLCF funds was inconsistent across States, making it difficult to determine whether the recipients of sub-grants were the most needy applicants.***

States generally targeted TLCF funds to needy districts by establishing a definition of need, and giving some priority to high-need districts in scoring sub-grant applications. Each of the case study States appeared to have interpreted targeting differently. Thus, the priority placed on need varied across the case study States, as did the manner in which need was defined.

Overall, in the States visited, the measurements used to define need considered both financial need (poverty) *and* need for technology. The specific ways each of the case study States treated need in awarding TLCF sub-grants is summarized in exhibit 6. The selection of TLCF recipients

EXHIBIT 6

Treatment of Need in Awarding Sub-grants

State	Definition of Need
Illinois	No specific indicator used
Massachusetts	Need index from three sources: Percent Free/Reduced Price Lunch students Percent spending below Foundation Budget (State spending marker) Percent spending on technology below State average
Mississippi	Provided additional points for following need indicators: 5 points if district's student to computer ratio greater than 14 to 1 10 points if district's student to computer ratio greater than 50 to 1 10 points if application targeted schools with low student achievement 10 points if district has a high poverty level
Texas	Percent Free/Reduced Price Lunch students
Washington	Multiplication of: Percent Free/Reduced Price Lunch students Student-to-computer ratio Percent unemployment Divided by: Readiness to benefit (current technology spending per student)

depended on the priority assigned to need as compared to other criteria in the sub-grant applications. Mississippi and Washington can be found on one end of the continuum. In Mississippi, where the poverty level is one of the highest in the nation and the level of technology infusion among the lowest, targeting funds to districts in need was not a major difficulty or source of debate. In Washington, 60 percent of the TLCF was designated for high-need districts, and future plans indicated that subsequent years' funding would be set aside entirely for this type of district.

On the other end of the continuum are Illinois and Massachusetts. In Illinois, the Department of Education sought an allocation approach that did not rely too heavily on need. In the case of Illinois, TLCF funds were allocated to seven hubs around the State. This enabled funds to be distributed around the State and not just to the Chicago area which, with its depth of poverty and sheer number of students, would otherwise have received the lion's share of the State's $9.1 million allotment. In designing the State TLCF program, Massachusetts divided its allocation into four separate pots of money, only one of which included need as a criterion for award. The overall de-emphasis on need in the State TLCF program was intentional, since the State Department of Education felt that the needy districts were receiving substantial State support through pre-existing reform initiatives.

Texas fell somewhere in between the cases described above. Since districts that were above the statewide poverty median could have received TLCF funds, Texas chose to emphasize the need for technology more than poverty. State officials supported the notion that the most impoverished districts have access to more external resources than less poor districts.

According to several State and district officials, however, the demonstration of poverty, in particular, was not as straightforward a matter as one might think. Some administrators described concerns with the standard use of the "free and reduced price lunch" indicator, suggesting that it could sometimes mask the actual level of poverty—although there was no evidence of the magnitude of this problem. For instance, one district official in Washington noted that many secondary students in his district did not claim the free-lunch benefit, because it was socially embarrassing for them to do so. Some States anticipated this problem and allowed their districts to include narrative descriptions of their particular needs.

Due in part, perhaps, to these tensions and the caveats with which some States addressed the targeting issue, the characteristics of the recipients indicated that a wider variety of districts received TLCF sub-grants than perhaps would have been expected.

Observation 4: ***Leadership at the State, district, and school levels was critical to the implementation and operation of the TLCF.***

Many different factors influenced the ability of States and districts to implement technology programs in their schools and many factors appeared to determine how smoothly States and school districts were able to apply for TLCF sub-grants and implement them once awarded. How do you explain the difference between two school districts that appeared similar on paper with regard to their poverty status, test scores, and per pupil expenditures, yet the implementation of technology in one of these districts proceeded much more smoothly than in the other? People made the difference!

At the district and school levels, the implementation of the TLCF projects that were observed were often tied to the leadership of those who had written the TLCF sub-grant and who were administering the project at the local level. The commitment of superintendents and principals also influenced implementation. In one district, a superintendent was interviewed who did not use a computer (he did not even have one in his office). In more than one district, district-level technology coordinators also assumed a myriad of other responsibilities; they were the curriculum coordinator, the Title I coordinator, and the Eisenhower coordinator. At the same time, the numbers of computers in the classroom in some of the smaller and poorer school districts rivaled wealthy districts, and their use could have served as models for other classrooms across the nation. These districts tended to have technology coordinators whose primary responsibility was that of administering the technology programs and who were creative in using a variety of grants (e.g., Title I, Eisenhower) to purchase computers and other technology for their schools.

All programs depend upon the people who design, implement, and administer them, but programs as flexible as the TLCF rely even more on leadership. Those sub-grants that appeared to be most successful in implementing their projects were those with some type of leadership—whether it was the superintendent, principal, or technology coordinator—who could look beyond the TLCF award and creatively and energetically think beyond the confines of their schools and districts.

How Were States and Districts Using the TLCF?

The flexibility of the TLCF was perhaps illustrated most clearly when examining the many ways local school districts and schools were using the TLCF sub-grants. The five case study States provided considerable variety in the ways one can think about the use of technology in schools and classrooms: the districts visited were using the TLCF to support new ways of teaching and learning, to reach a wide variety of students, to purchase different kinds of equipment, and to help teachers learn how to use technology effectively.

Observation 5: ***The TLCF was being used to support teaching and learning in a variety of different ways.***

Districts in the States visited were using the TLCF in a variety of ways to support improved teaching and learning. Projects' activities ranged from providing professional development activities to developing new assessments with technology, from increasing students' access to information resources via Internet connection to supporting the integration of technology into a particular course's curriculum. For instance:

- In Columbia, Mississippi, the TLCF was used to train teachers in the use of portfolio assessment, which would allow students to take an active part in the evaluation of their academic progress. The grant also provided an Internet connection that allowed middle school students to participate in collaborative projects with students in New England—in the spring of 1997, the students were going to take a field trip to meet their cyber-classmates.

- On an Indian reservation in Washington, the TLCF put a variety of hardware and software tools in the hands of a special education teacher for use with her 30 special education students to improve their writing and communication skills. One notable

aspect of the grant was allowing students to "check-out" portable computers for use at home, the efficiency of which inspired many students to complete more schoolwork outside the classroom.

- In Western Massachusetts, the TLCF was used to support an Internet Academy, required for every eighth-grade student, which taught about networks and how to navigate the Internet. This approach was an attempt to ensure that all students would have the skills necessary to take advantage of the resources of the Information Superhighway.

- In Texas, the TLCF was used in one district to provide intensive professional development on the integration of technology into the curriculum during "Summer Institutes." The grant also provided for ongoing support—the often-forgotten piece of professional development—throughout the school year.

- In a rural district in Illinois, the TLCF was used to support a hands-on science project in which students used portable, durable Apple E-mates and attachments to study local water quality.

Technology Alone Is Not Enough

Many of the schools visited still maintained computers that by any technological standard would be considered obsolete. Yet, creative teachers and technology coordinators put many of these machines to good use—allowing them to teach in different ways or to save money for the school. For instance, one technology coordinator at a school for the deaf and hard of hearing demonstrated how she had converted 10-year-old computer monitors into televisions that are used for instruction. Another elementary school teacher of at-risk inner city youth collected and refurbished decade old Apple computers for his classroom, allowing him to maintain a student-to-computer ratio approaching 2 to 1. While he had one machine with an Internet connection that he had recently obtained and was beginning to use in his teaching, these older machines were in constant use.

On the flip side, classrooms were visited that had recently received new computers replete with all the bells and whistles to attract kindergarten and pre-school age children. In one of these classrooms, all the children sat in a circle around the one computer and the teacher who called upon them to come to the front of the class to push the right button. A librarian who had no idea how to access the Internet, even though she had a connection to it, was also observed.

These examples illustrate that technology alone does not make the difference, but rather how it is used. State-of-the-art technology in the hands of teachers with little or no professional development and little motivation to use it will have less impact on students than older equipment in the classrooms of teachers who have had professional development and want to use it effectively.

This variety in the ways States were using the TLCF reflects the spirit of the program. The TLCF was designed to help States implement their technology plans. The educational and technology needs of States varied, and this was reflected in State technology plans and in the uses of the TLCF.

Observation 6: The TLCF was being tailored to specific groups of students within districts.

Just as the States were targeting the TLCF sub-grants to districts within their States, the districts themselves were targeting their sub-grants to specific groups of students. Rarely did a

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district use its TLCF award to provide technology to all of its students. Some of the ways districts tailored their awards to specific students include:

- In Clarksdale, Mississippi, the TLCF award was being used to provide hardware and software to kindergarten and special education students.
- A consortium in Washington State also provided technology to special education students in three districts (see box below).
- In a school in Massachusetts, funds were used to help provide resources for deaf and hard of hearing students.
- TLCF money was targeted to students in grades 4–6 in Columbia, Mississippi, so that they could use multimedia technology to develop portfolios.
- In a small district in Washington, the TLCF was used to support social studies students in selected classrooms, through the purchase of multimedia presentation stations.
- In Hudson, Massachusetts, the TLCF was used to support teacher professional development relative to the Virtual High School program, targeting high school students in Hudson and across the country. This program provided many students with access to a full array of advanced courses that would not otherwise be available.
- In Texas, the TLCF was used to connect one elementary school to the school system's LAN.

In Grand Coulee, Washington, the TLCF supported the purchase of Apple E-mates and various software packages for use by special education students. However, one key feature of the design and implementation of the project in Grand Coulee was that special education students, after a period of time, were to teach general education students how to use the technology. This had a major impact on the entire school; general education students began visiting the special education classroom on a regular basis, as the special education students had a renewed sense of importance and worth.

Perhaps most pertinent, classrooms and schools were observed that had never had a computer or other modern technology until the TLCF came along. Students were thus given access to technology that they had never had before. Not surprisingly, they approached the new hardware and software enthusiastically, sometimes more so than their teachers who did not always have time to be trained.

Observation 7: The TLCF was supporting a broad range of professional development efforts.

All States and districts that were visited were using some of their TLCF award to support professional development for teachers. In Mississippi, sub-grant applicants were required to allocate 20 percent of the funding to teacher training. In Illinois, no less than 25 percent of the allocation was to be dedicated to professional development. The competition in Massachusetts included two specific programs that focused on professional development: a need-based professional development grant that supported professional development for teachers and administrators, particularly those who were in school districts that had high percentages of students in poverty and need for

technology; and a technology leader sabbatical that identified two educators to serve a 1-year sabbatical as statewide technology leaders to work with other teachers and administrators.

In addition, some States had developed statewide professional development programs that districts could use. In Mississippi, for example, "Teaching and Learning with Technology" was a professional development sequence that consisted of the following phases:

- **Phase I:** beginning level technology training for teachers who were "mouse illiterate." The workshops were conducted by expert teachers, and were held monthly throughout the State. At the time of AIR's visit to speak with State officials (late August 1997), 90 percent of the school districts had participated in the 4-day workshop, with teachers earning 2.4 continuing education unit (CEU) credits.

- **Phase II:** focused on topics such as multimedia, telecommunications, troubleshooting, and presentation tools. After completing the 5-day workshop, teachers earned three CEU credits and were believed to have the skills necessary to integrate technology into their classroom curricula.

- **Phase III:** the expert or "techie" level of training. This training provided in-depth, hands-on instruction in the design, installation, and configuration of Novell Networks. Participants earned eight CEU credits and had the opportunity to become Certified Novell Administrators.

In one of the districts visited in Mississippi, the State training program was considered too basic and the district provided its own training to teachers. In another district in the same State, teachers found themselves with computers for the first time and although the State training program was made available, many teachers had not yet participated.

Professional development in the Texas panhandle provided an interesting illustration of how technology itself could be used to deliver professional development. The Panhandle Consortium, comprising 34 districts in Texas' Education Service Center's Region XVI and headquartered in Amarillo, used its TLCF award to set up 15 videoconferencing sites for bringing professional development to this geographically vast region. The TLCF award allowed the Consortium to purchase the videoconferencing technology and laptops, as well as a professional development program for core teams of teachers from the participating districts that focused on the integration of technology into the curriculum.

In one district in Western Massachusetts, TLCF funds were used to support two professional development conferences related to the use of technology. Specifically, the Fund allowed technology leaders in the district to develop, market, and provide personnel and supplies for the two courses, which drew teachers both from within the district and from other districts in the State.

Observation 8: The TLCF was being used to purchase a wide range of hardware and software.

In many districts, the TLCF was used to purchase hardware and software:

- In Washington, the grant purchased multimedia stations with oversized monitors that could be viewed by an entire classroom of students.

- In both Washington and Illinois, districts purchased Apple E-mates (durable, portable computers) that could be used by students in their homes, in any classroom, or for field work outside the classroom.

- In Mississippi, the TLCF allowed one district to purchase software designed specifically for pre-school and kindergarten students.

- In Washington, a variety of assistive technologies, such as voice-recognition software, was purchased with support from the TLCF.

- In districts in Mississippi and Texas, the TLCF supported schools in purchasing equipment necessary to connect to the Internet.

- In Texas, videoconferencing equipment and laptop computers were purchased for use by teachers in 34 districts.

- In Northeast Mississippi, the TLCF purchased multimedia carts, printers, and televisions for use with lower elementary school students.

In Clarkston, Washington, the TLCF supported the purchase of multimedia presentation stations, including 30 inch monitors, for use in social studies classrooms. However, after 1 year of implementation, the district learned several important lessons. First, it learned that it was important to include peripheral equipment, such as printers and carts, in funding requests, because they improved the efficiency of the use of the high-powered technology. Also, they decided that, in the future, the concept would be more effective scaled-up to provide a "mini-lab" of at least five multimedia presentation stations per classroom.

How Did TLCF Activities Relate to Other Technology and Reform Efforts?

The TLCF does not operate in a vacuum, but rather is embedded in a variety of national, State, and local technology and reform efforts. The TLCF is one of many educational reform efforts that can also support technology. Furthermore, the non-regulatory guidance explicitly describes how technology can assist in school reform efforts. Proponents of technology rarely advocate that technology is an end in and of itself. The promise of technology's use in education lies in its potential to provide opportunities for students which they could not have without technology, to teach students technology skills that they will need in the workforce, and to improve basic academic skills. Thus, the success or failure of the TLCF will very much depend on its relationship to other technology and reform efforts.

Observation 9: ***The TLCF appeared to function best when implemented in the context of other technology programs.***

The relative contribution of the TLCF can best be understood when examined alongside other technology programs. In the case study States, the number and size of existing technology initiatives varied widely. In some States, the amount of TLCF funding represented a small portion of the total amount spent on technology. Indeed, one State technology coordinator described the

financial contribution of the TLCF as "a drop in the bucket." In other cases, the TLCF was a primary source of technology funding. As an example, in Washington State, the TLCF was a small, but important part of technology funding, as it was one of the only grants that did not require districts to match funds. In Mississippi, local funding sources were scarce; thus the TLCF played a major role in some districts, introducing computers to schools and students for the first time. In Texas, the TLCF was relatively small compared to technology spending overall, but the State's decision to award a small number of large sub-grants resulted in major impacts in those districts receiving awards. Exhibit 7 presents some of the ongoing technology initiatives in the five case study States.

Many States were using TLCF funds to supplement ongoing technology projects. Hudson, Massachusetts received a Technology Innovation Challenge Grant to establish the Virtual High School, an online project that offered 29 different courses that students across the country could take. Hudson also received a TLCF sub-grant from the State to provide professional development to its teachers. In several of the sites in Texas, the TLCF awards operated alongside money from the State Telecommunications Infrastructure Fund. Indeed, the two sources of funding worked so closely together that at times computers were purchased with one funding source and a component within it was purchased from the other.

Observation 10: Other non-technology programs can also support technology needs.

There are many ways to fund technology needs that go well beyond Federal and local technology initiatives. Indeed, impressive amounts and uses of technology were observed in several relatively poor school districts. Creative technology coordinators used resources from a number of different programs to amass computers and other materials for their schools. In Columbia, Mississippi, for example, funds from a variety of Federal programs were pooled to provide four to six computers per classroom in a middle school. In the State of Washington, a school on an Indian reservation used resources from Federal Impact Aid, the Bureau of Indian Affairs, and Title I to fund a computer lab as well as provide computers in its classrooms. Also in Washington, Clarkston cited considerable support not only from the State, but also from the Eisenhower Professional Development Program, Goals 2000, Title VI, and Title I. The intent of the TLCF is *not* to be the sole, or even primary, source of funds for educational technology. At least in the five States visited, the use of the TLCF appeared to be well coordinated with other possible sources of funding.

Observation 11: The TLCF is best understood within the context of State and districtwide reform efforts.

Technology is not an end in and of itself, but rather a means to improve teaching and learning. Nowhere is this seen more clearly than in situations where technology was well integrated into local school reform efforts.

In Illinois, a primary criterion for sub-grant funding was demonstration of "engaged learning." According to State documents, students are engaged learners when they are (1) responsible for their own learning; (2) energized by learning; (3) strategic learners; and (4) collaborative learners. The State used the TLCF to promote its belief in this learning philosophy. In Christopher, students selected research topics focusing on the community and used technology

EXHIBIT 7

Technology Initiatives of Case Study States

Illinois	Statewide initiatives provided $3,000,000 (FY97) and $43,750,000 (FY98) for: Museum in the Classroom On-Line Curriculum Projects Building-Level Innovations with Technology Technology Infrastructure Fund (provides funds for poor districts, based on a foundation amount + $75/student)
Massachusetts	**(Please note that numbers are given in total amounts rather than per year)** Educational Technology Bond Bill ($60,000,000 total, $30,000,000 for K-12) distributed on a $30/student basis Education Reform Act of 1993 increased funding to needy districts without restrictions on how the money is spent—some of the money is spent on technology State technology budget ($2,970,000 in budgeted funds and an additional $15,400,000 appropriation from the legislature of surplus funds) Information Management System (being constructed with $2,000,000 in Bond bill funds and $15,000,000 from the State tech budget Educational Technology Service Integration and Universal Service Fund
Mississippi	Education Technology Enhancement Act (In 1996, $1,000,000 was appropriated for backbone) State investment in Tech Prep ($49,000,000 since 1993) Goals 2000 grants The State has a deal with Bell South and local Internet provider to give free Internet access and e-mail to educators
Texas	Technology Allotment to all schools of $30/student (FY97=$109,000,000) TENET (Texas Education Network) text-base computer network providing Internet and other services to educators (FY97=$2,900,000) TETN (Texas Education Telecommunications Network) statewide Intranet primarily used for videoconferencing (FY97=$50,000) (Note: $2,000,000 in FY95) T-STAR (Texas School Telecommunication Access Resource) statewide satellite network available to all districts (FY97=$2,000,000) TCET (Texas Center for Educational Technology) research center (FY97=$400,000) Technology Preview and Training Centers located at ESCs (FY97=$8,000,000) Texas Library Connection library resource (FY97=$650,000) Projects for Educational Technology demonstration programs (FY97=$1,000,000)
Washington	The 1997 legislature included $19,500,000 each for 1997–98 and 1998–99 for competitive technology grants—15-25% of funds set aside for "needy" populations and 20% of award must go to professional development K-20 Network (Approximately $52,000,000 total appropriated for backbone) Educational Savings Account for spending excess State revenue on educational technology Learning Space grant program (collaborative with U.S. West the phone company) to train teachers BESST (Building Excellence in Social Studies) teacher training program SLIG (Student Learning Improvement Grants) providing materials, as well as 3 days of planning and professional development time

and community resources to complete the project. Using the Internet, they discovered considerable information about Christopher and the surrounding towns. They also interviewed community members and called a town meeting as part of the project.

Los Fresnos, Texas, located in the Rio Grande Valley about 15 miles from the United States-Mexican border, implemented a number of reform initiatives in an attempt to improve student learning. The ultimate goal was to increase scores on the Texas Assessment of Academic Skills (TAAS) and between 1993–94 and 1996–97, the percentages of students passing in reading, mathematics, and writing increased dramatically. A large TLCF sub-grant ($644,442) to Resaca Middle School supported a number of reform-related activities, that included acquiring hardware and software to assist students in improving their basic skills; developing a parent computer center that would both assist parents in obtaining the GED and job skills, as well as get them involved in their children's education; providing professional development for teachers; hiring a full-time technology facilitator; and connecting with wide area networks for purposes of accessing information, particularly from institutions of higher education.

Columbia, Mississippi is another example where TLCF funds supported a reform effort. Funds were directed to specific activities within the larger reform agenda, including training teachers to integrate technology into the curriculum and promoting the use of portfolio assessment. A town of about 11,000 in southeast Mississippi, Columbia developed a technology plan in 1995. Focusing on integrating the Internet and multimedia presentation tools into the curriculum, the plan consisted of three phases: (1) creating local area networks (LANs) in each of Columbia's schools; (2) creating multimedia computer labs in each of the elementary schools and in the libraries of the middle and high schools; and (3) establishing a districtwide network. The TLCF funds were being used to accomplish two main goals: training teachers in grades 4 through 6 to utilize multimedia technology and portfolio assessment to create and develop curriculum that fosters student growth and development; and assisting teachers in creating a technology portfolio using multimedia technology.

CONCLUSIONS

Observing five States' efforts to get the TLCF off the ground provided a unique opportunity to understand how a broad-based program gets translated to meet a wide range of very different educational and technology needs. Illinois, Massachusetts, Mississippi, Texas, and Washington, are certainly very different States with regard to their educational histories. The States also were in fairly different places with regard to technology when the TLCF was announced. Each State shaped its use of the TLCF differently, in order to address its own perceived needs and to further implement its own technology plans.

Multiple visits to these five States revealed considerable promise with regard to technology's role in education. Children in impoverished school districts were observed using computers for the first time in their lives. Special education students became the envy of other children in their schools, because they had access to "neat" computers. Children in a rural Mississippi school district were working on a project with students in New England via Internet. High school students proudly described how they wired their local elementary school. And teachers who had been teaching for many years expressed a belief that their newly acquired technology was improving how they taught and how students learned.

This is not to say that all was positive. As noted earlier, also observed was a classroom of kindergarten children huddled around the teacher and their one computer, being called to the front of the class to "push the right button." Teachers and other staff who had not yet had professional development in the use of technology were interviewed. Frustrations resulting from school buildings so old that infrastructure issues hindered even the most basic use of technology emerged in many districts.

At the time of the site visits, it was too early in the course of the TLCF to determine what impact it would have on education. The TLCF's ultimate goal, as well as that of other technology initiatives, is relatively simple: to improve teaching and increase student learning. States and selected districts were visited at a very early stage in the program, just as States were receiving funds from the U.S. Department of Education and districts were attempting to implement their recently awarded sub-grants from their States. But it was not too early to identify the program areas that could, in the end, determine the success or failure of the nation's use of technology in K–12 education. Thus, although these observations occurred at an early point in the implementation of the program, a number of areas that warrant close attention could be identified.

Observation 12: The TLCF's success or failure will depend on not spreading funds too thin.

Those who developed the TLCF were well aware that the program's financial contribution to even the most conservative estimates of technology needs in our nation's schools would be, to use the term of one State technology coordinator, a mere "drop in the bucket." The TLCF does not intend to provide the resources needed to cover all educational technology needs—from hardware, software, infrastructure improvements, professional development, connectivity costs, and technical assistance—but rather to fund those schools and students who were being left behind and to stimulate other contributions. Thus, the TLCF legislation and guidelines recognize the need to concentrate the TLCF's limited resources so that they would make a difference.

Most of the States visited appeared to be taking seriously the U.S. Department of Education's guidelines that States should make awards of "sufficient duration, size, scope, and quality" to make a difference. Typically, States awarded a limited number of sub-grants to districts, and districts themselves generally focused their awards on specific schools or groups of students (e.g., special education, kindergarten students, and students in grades 4 to 6). The way one State handled the TLCF, however, provides a good illustration of why the TLCF guidelines emphasized that funds not be spread too thin. Massachusetts, one of the smaller States visited with regard to the number of students, awarded 121 sub-grants, some as small as $3,000. The U.S. Department of Education, in reviewing Massachusetts plan for distributing the funds, asked that the State target its TLCF money more on the basis of poverty in subsequent years. Spreading limited amounts of money to numerous recipients not only goes against the program's guidelines, but dilutes any potential impact the program could have.

However, making a judgment about whether TLCF funds were being spread too thin is not straightforward; such a judgment can only be made in the context of other funding for technology within a State. Several States that were not among the five case-study States also appeared to spread their TLCF funds across many districts in relatively small amounts. In at least one case, however, TLCF sub-grants were awarded in conjunction with State money and the two sources together appeared to be well designed and sufficient to make a difference in the districts. There could be

circumstances where the TLCF may initially appear to be spread too thin, but upon further examination, its distribution would be sufficient in combination with other available resources.

Observation 13: Identifying districts with the greatest need provided a challenge to States in implementing the TLCF.

The rationale of the TLCF incorporates not just the notion of concentrating funds so that limited resources could have an impact, but also the notion of targeting funds to students who need it the most. What is meant by need, and operationalizing the concept, raises questions about the implementation of the legislation.

The non-regulatory guidance for the TLCF states: "A key purpose of the program is to enable the States to assist school systems that have the highest numbers or percentages of children in poverty and demonstrate the greatest need for technology" (U.S. Department of Education, 1996). Thus, need becomes a double-pronged concept: it is based on economics, as well as some unspecified lack of technology. This notion raises some interesting issues. One of the States visited suggested that they did not necessarily target the TLCF to the poorest districts, because the technology needs of the poorest districts had been taken care of through other funding. Officials in this State argued that school districts whose students may be poor may not necessarily have the greatest need for technology. Indeed, a district was visited where an extremely creative and energetic technology coordinator pooled resources across many programs (e.g., Title I, Eisenhower, Goals 2000). Classrooms observed in his district often had as many computers and other related equipment as some wealthier districts.

Does this mean, however, that students who reside in impoverished districts have less need? One could easily argue that students in these districts are less likely to have access to computers and other technology at home (National Telecommunications and Information Administration, 1998), and therefore need even more access at school than students in wealthier districts. Simple counts of students-per-computer without considering other circumstances would dictate practices that could increase disparities rather than alleviate them.

It was certainly the case that the five case study States treated the issue of need differently, ranging from essentially ignoring it altogether to explicitly giving extra points to districts with both poor students and limited numbers of computers. Given the potential tension between definitions of need that focus on district poverty rates and those that focus on availability of technology, States may need more information about Federal intent. Given the diversity of State needs and circumstances, the Department of Education may wish to work closely with States to clarify ways to target funds on districts with the greatest need, taking into account each State's unique circumstances.

Observation 14: Sustaining technology's use in schools and classrooms will be one test of the TLCF's success.

The TLCF legislation implicitly recognizes that it is providing a relatively small share of the total amount of money needed for educational technology; it therefore acknowledges that a number of features must be in place if the program is to have a lasting impact. The applications themselves required a description of "(1) long-term strategies for financing educational technology in the State," and "(2) how business, industry, other public and private agencies, including libraries, library

literacy programs, scientific and cultural institutions, and institutions of higher education can participate in the ongoing planning, implementation, and support for the plan" (U.S. Department of Education, 1996). Furthermore, the non-regulatory guidance describes how the TLCF relates to other Federal technology and school reform initiatives. Sustainability of the program beyond TLCF funding, therefore, requires that a number of features be in place: support from local school districts; support from the local community—its businesses as well as its social, cultural, and other educational institutions; connections to other education programs, even if their focus is not specifically technology; and connections to other technology initiatives.

A few of the schools and districts visited had in place all of these features of a sustainable program. However, a number of signs indicated that sustaining the TLCF beyond its funding cycle would be a problem for many of the districts in these case studies. Several of the poorer districts lamented over the problems of obtaining community support when their communities themselves were poor. In some cases, the businesses that were there were struggling themselves. One interviewee commented: "There are no businesses in this community (at least not the kind that are inferred when we speak of 'community partnering'). Who am I supposed to partner with, the liquor store on the corner?" The economic situation in these communities also translated into less support for school budgets and therefore less support for technology initiatives. Furthermore, the single year of funding that most sub-grantees receive from the TLCF does not last long enough to establish long-lasting community initiatives.

Examples of poorer districts taking advantage of a variety of other Federal and State programs that allowed them to bring technology into their schools were observed. In these cases, the impetus for this typically came from the vision of creative leaders.

Observation 15: ***Leadership at the State, district, and school levels is critical to the operation and sustainability of technology initiatives.***

What is the best way to ensure that the TLCF assists schools to use technology effectively? Although it may appear to be a simple response, one answer is "leadership." Reflecting upon the variations observed across States, districts, and schools, one common element in the more promising programs tended to be the person or persons responsible for designing and implementing the program. Two districts within the same State could, and did, appear vastly different despite somewhat similar social and economic circumstances. The difference was often the person or persons leading the effort to bring technology into the district's schools.

Leadership is not innate. It can be taught and cultivated. The Federal government itself has vehicles for supporting technology leaders. The work of the Regional Technology Education Centers (R*TECs), the Eisenhower National Clearinghouse (ENC), and the Regional Educational Laboratories all could help foster local technology leadership. The development of leadership should also be focused on districts with the greatest need, providing them with technical assistance in grant writing and helping them to develop their own technology leaders. If the TLCF is to succeed, attention will need to be focused on developing leadership, not just at the State level, but also at the district and school levels.

Observation 16: ***The flexibility of the TLCF requires careful monitoring on the part of the Federal government.***

These case studies revealed almost as many adaptations of the TLCF as there are States and districts. The flexibility of the program allows States, districts, and schools to fit the TLCF into its ongoing technology and educational reform initiatives. While this flexibility is certainly one of the program's strengths, it also has the potential of being one of its downfalls. For although most of the States and districts visited appeared committed to implementing the TLCF in the spirit in which it was intended—concentrating awards, identifying districts with need, and integrating technology into the curriculum—several contrary examples were found. Programs emphasizing flexibility require careful monitoring; otherwise almost any practice can be justified as acceptable.

It will be important to monitor how States distribute funds to local districts. Not spreading limited resources too thin is important to the program's success. Yet it will remain important to examine the context in which decisions are made regarding the distribution of funds.

Monitoring how States define and operationalize need under such a flexible program will also require careful monitoring and attention to the State context. As observed, there are multiple ways of thinking about need, any of which could be appropriate depending upon the presence or absence of other technology initiatives. Ignoring need, however it may be defined, does not seem appropriate. Flexibility should not become an excuse for adopting any practice that seems convenient.

In this context, the Federal government will have to adopt creative approaches to communicating the intent of the TLCF, while at the same time adapting to local circumstances. Monitoring a program as flexible as the TLCF is indeed a challenge, but one that could serve as a model for many other Federal programs as well.

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